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Gromes, Sr.

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(54) **SURFACE CLEANING DEVICE AND METHOD OF OPERATION**

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A47L 11/40	(2006.01)
B05B 13/00	(2006.01)
E01H 1/10	(2006.01)

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CPC ***B05B 3/02*** (2013.01); ***A47L 11/00*** (2013.01); ***A47L 11/4038*** (2013.01); ***A47L 11/4044*** (2013.01); ***A47L 11/4069*** (2013.01); ***A47L 11/4072*** (2013.01); ***A47L 11/4077*** (2013.01); ***A47L 11/4088*** (2013.01); ***B05B 13/005*** (2013.01); ***E01H 1/101*** (2013.01)

(58) **Field of Classification Search**

CPC B08B 3/024; B08B 2203/02; B05B 3/02; B05B 13/005; A47L 11/00; A47L 11/4038; A47L 11/4044; A47L 11/4069; A47L 11/4072; A47L 11/4088; E01H 1/101

See application file for complete search history.

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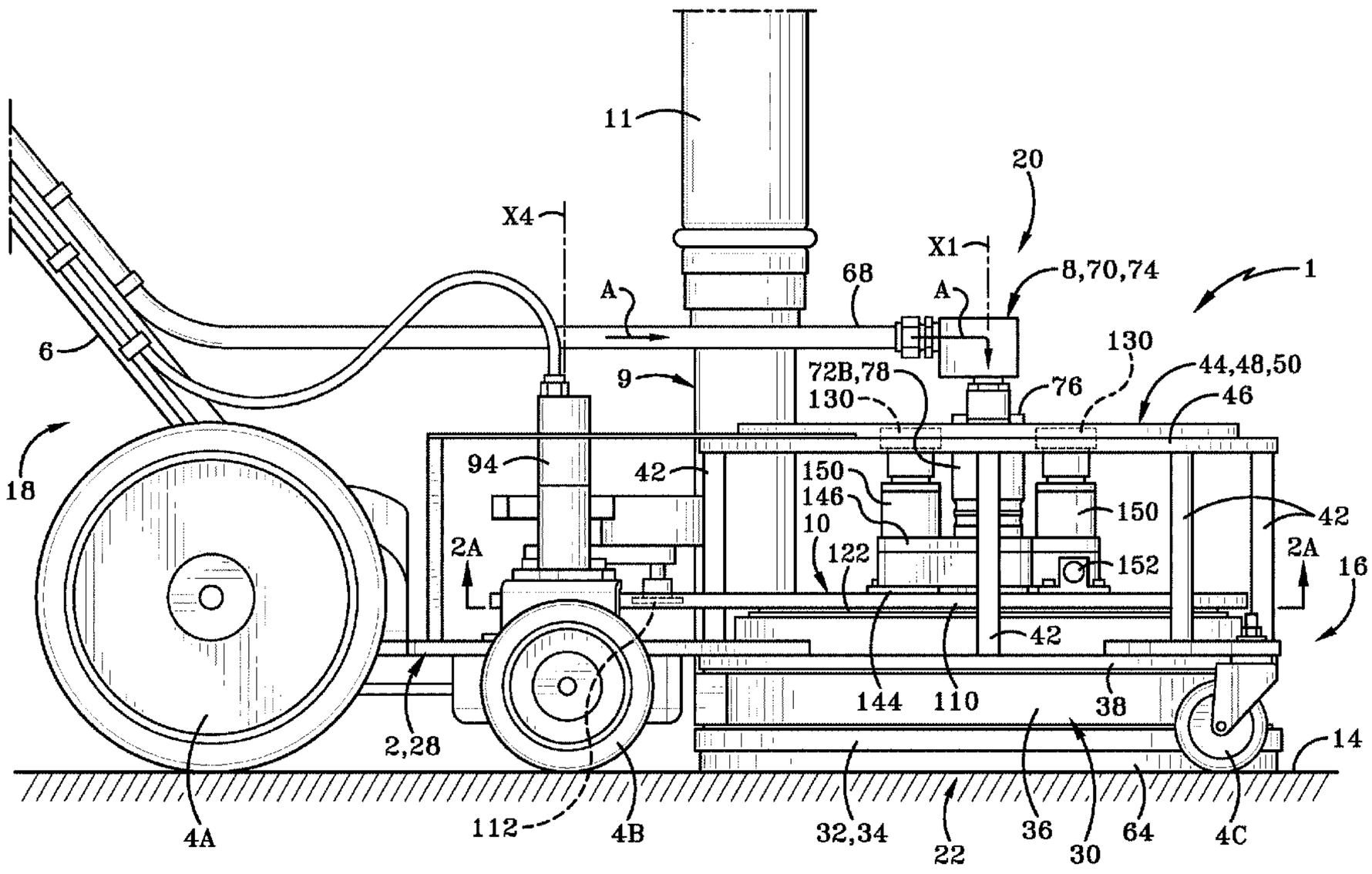
(57) **ABSTRACT**

A surface cleaner and method of operation are provided wherein the surface cleaner may include a rotatable nozzle assembly with one or more nozzles which may expel water onto a target surface to be cleaned.

9 Claims, 10 Drawing Sheets



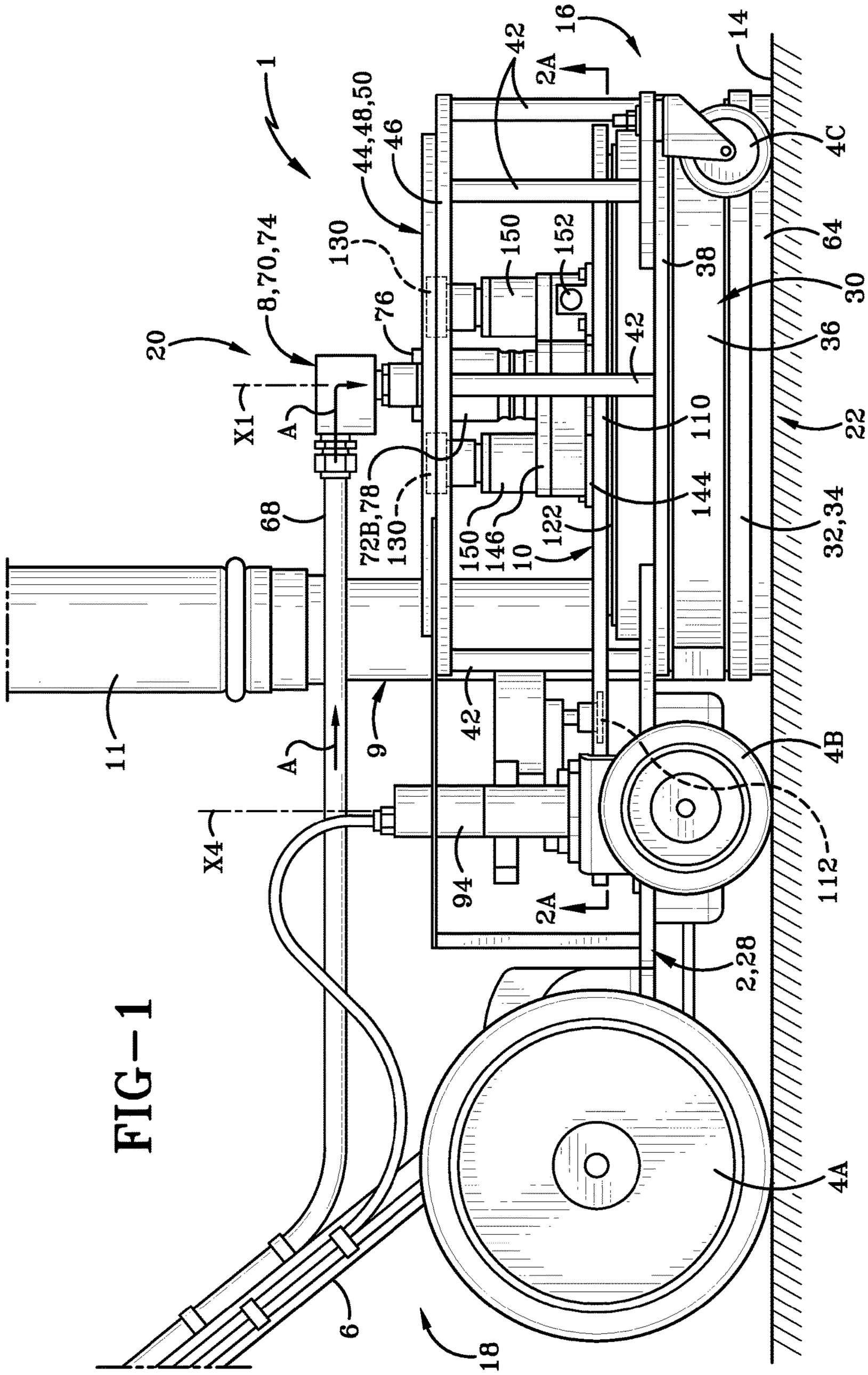

1
16
14
42
2A
44,48,50
46
4C
8,70,74
130
150
152
64
38
30
76
42
36
20
X1
A
110
22
68
72B,78
130
150
146
10
122
144
32,34
11
A
9
42
4B
X4
94
2A
112
28
2,28
4A
6
18

FIG-1

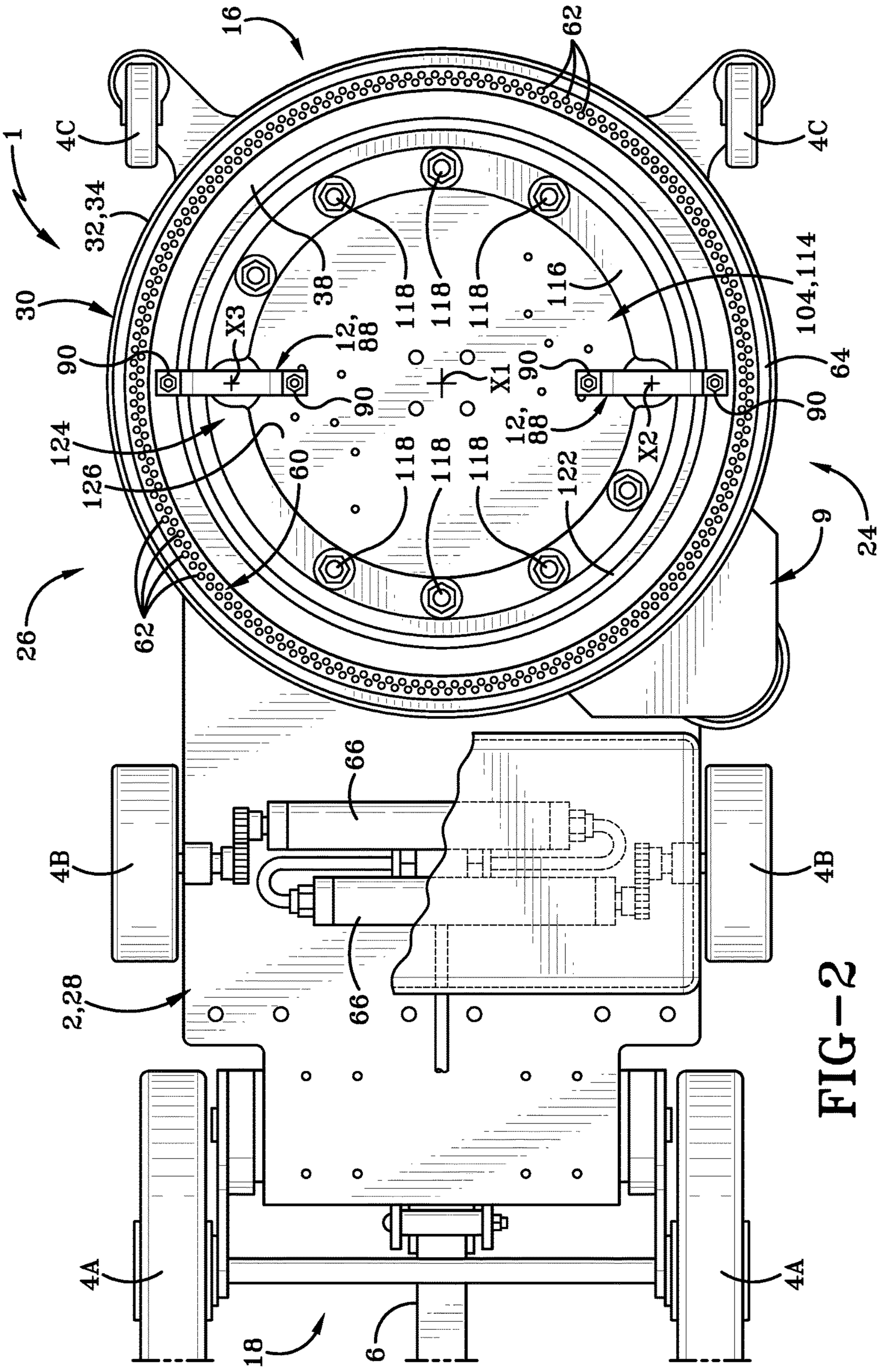

16
62
4C
4C
1
32,34
30
38
118
118
118
116
104,114
90
X3
12,
88
90
X1
90
12,
88
64
90
124
126
60
118
118
118
122
X2
62
26
9
24
66
4B
4B
2,28
66
4A
4A
18
6

FIG-2

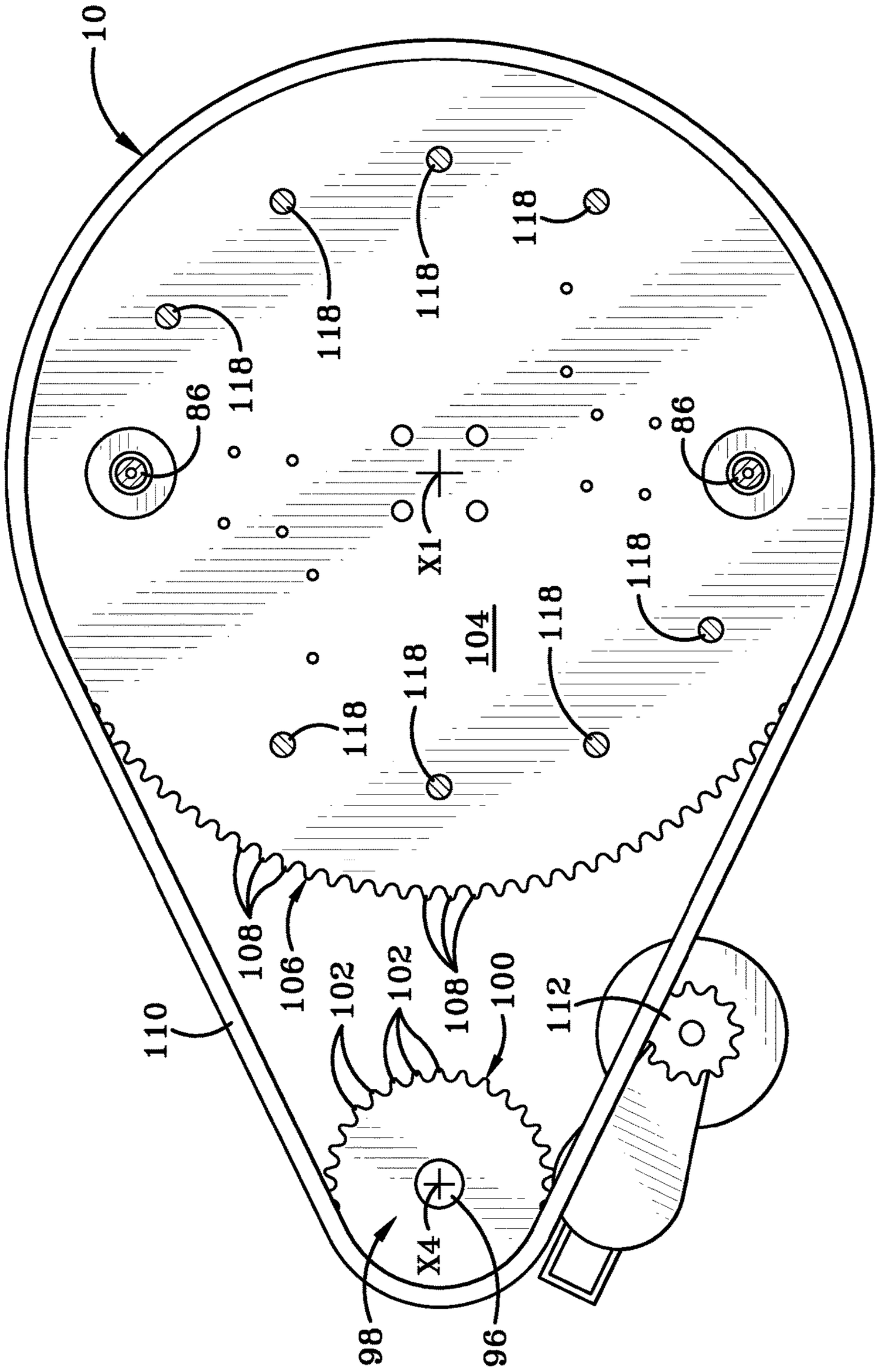

10
118
118
118
118
86
118
X1
118
104
118
118
118
86
108
106
102
102
108
100
112
110
X4
98
96

FIG-2A

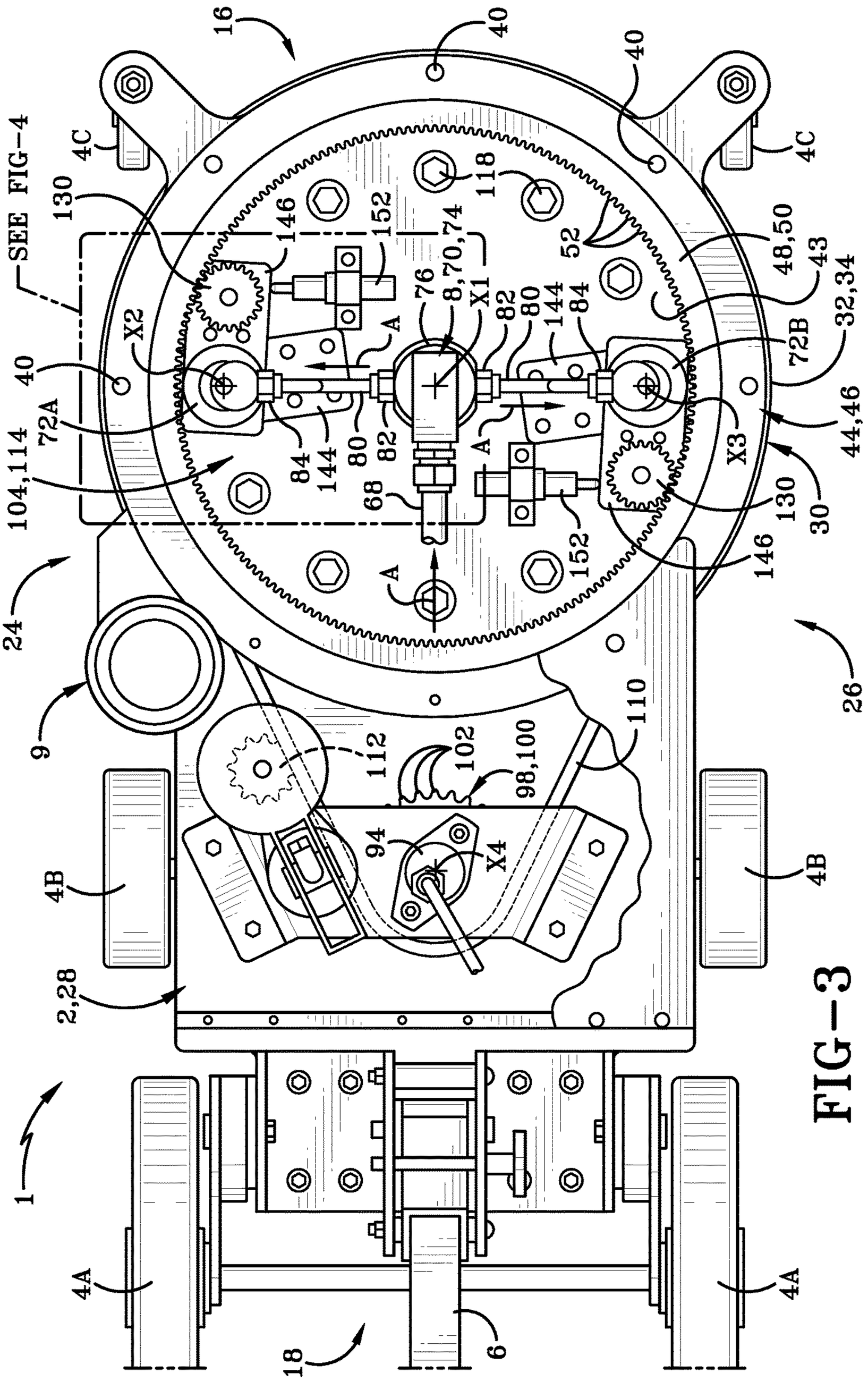
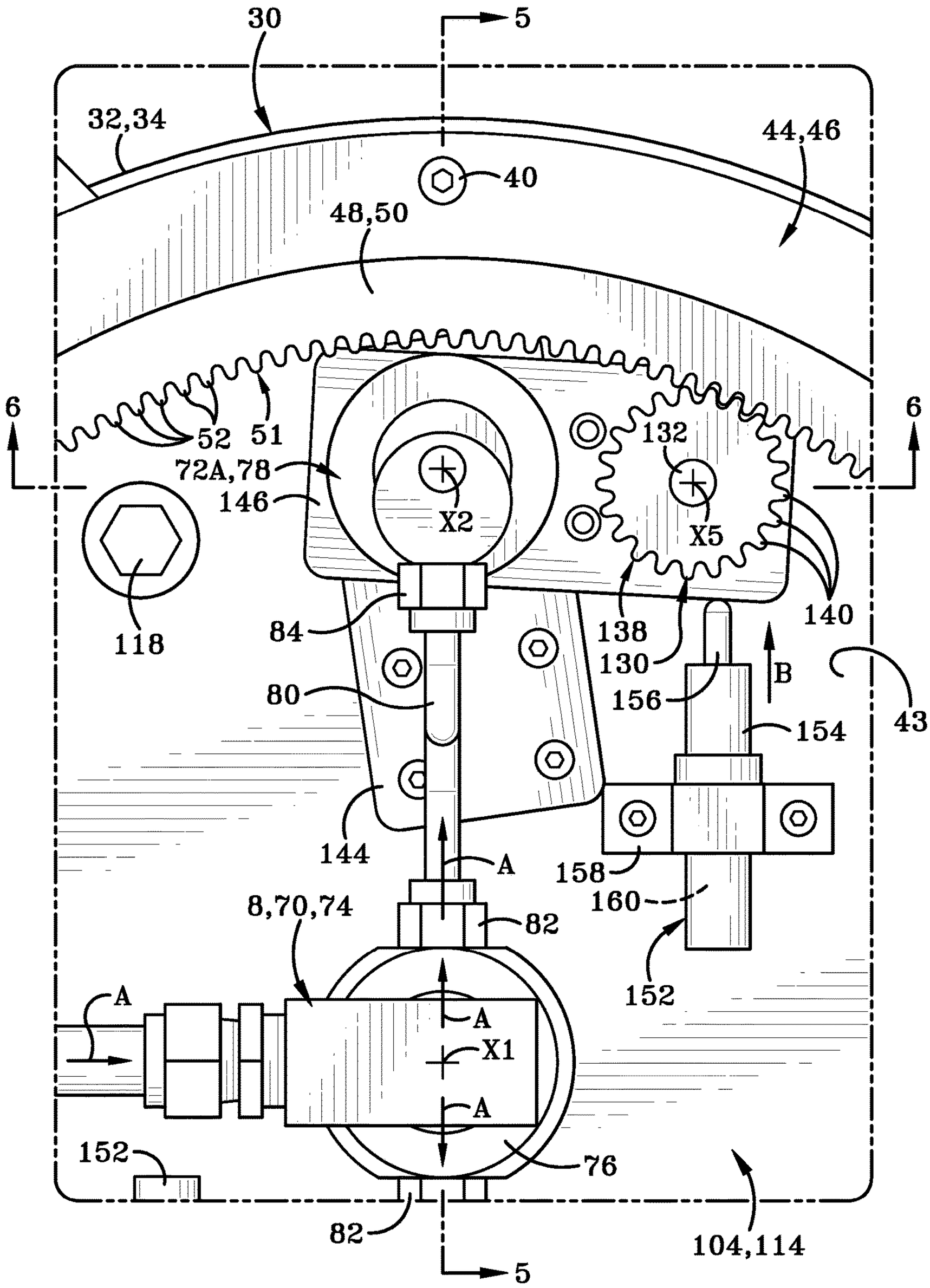

16
40
40
4C
4C
SEE FIG-4
130
146
152
118
52
48,50
43
76
8,70,74
X1
82
80
144
84
72B
32,34
X2
40
72A
104,114
84
144
80
82
68
A
A
A
X3
44,46
130
30
146
152
24
9
110
112
102
98,100
94
X4
4B
4B
26
2,28
1
4A
4A
18
6

FIG-3


30
5
32,34
44,46
40
48,50
6
6
52
51
72A,78
146
X2
132
X5
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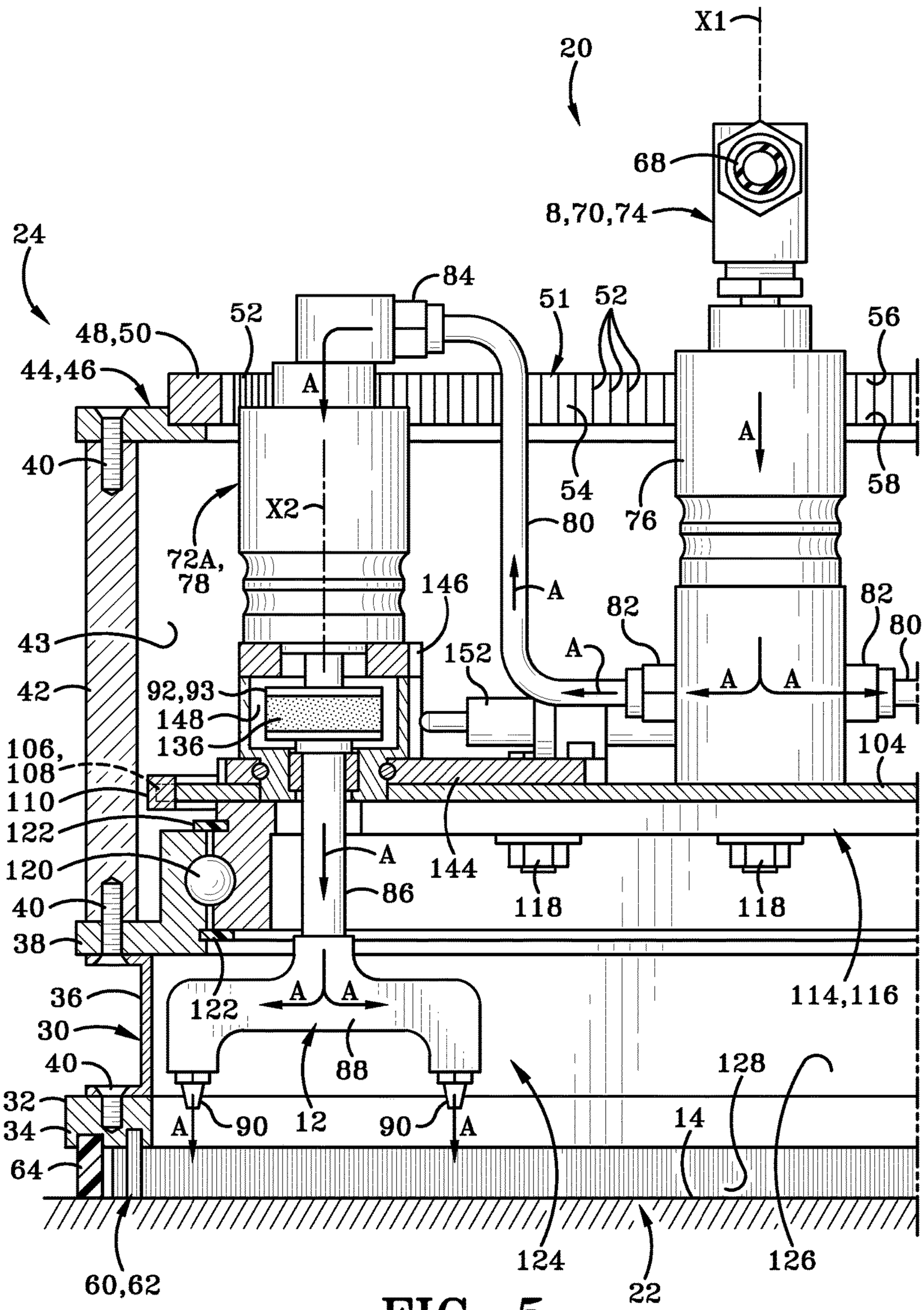
138
130
140
80
B
156
154
43
144
A
158
160
8,70,74
82
A
A
X1
A
152
76
152
82
104,114
5

FIG-4


X1
20
68
8,70,74
24
84
52
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48,50
44,46
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56
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54
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X2
80
76
72A,
78
146
A
82
82
80
43
152
A
A
A
42
92,93
148
136
106,
108
110
122
120
40
38
104
144
A
86
118
118
36
30
40
32
34
64
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114,116
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128
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90
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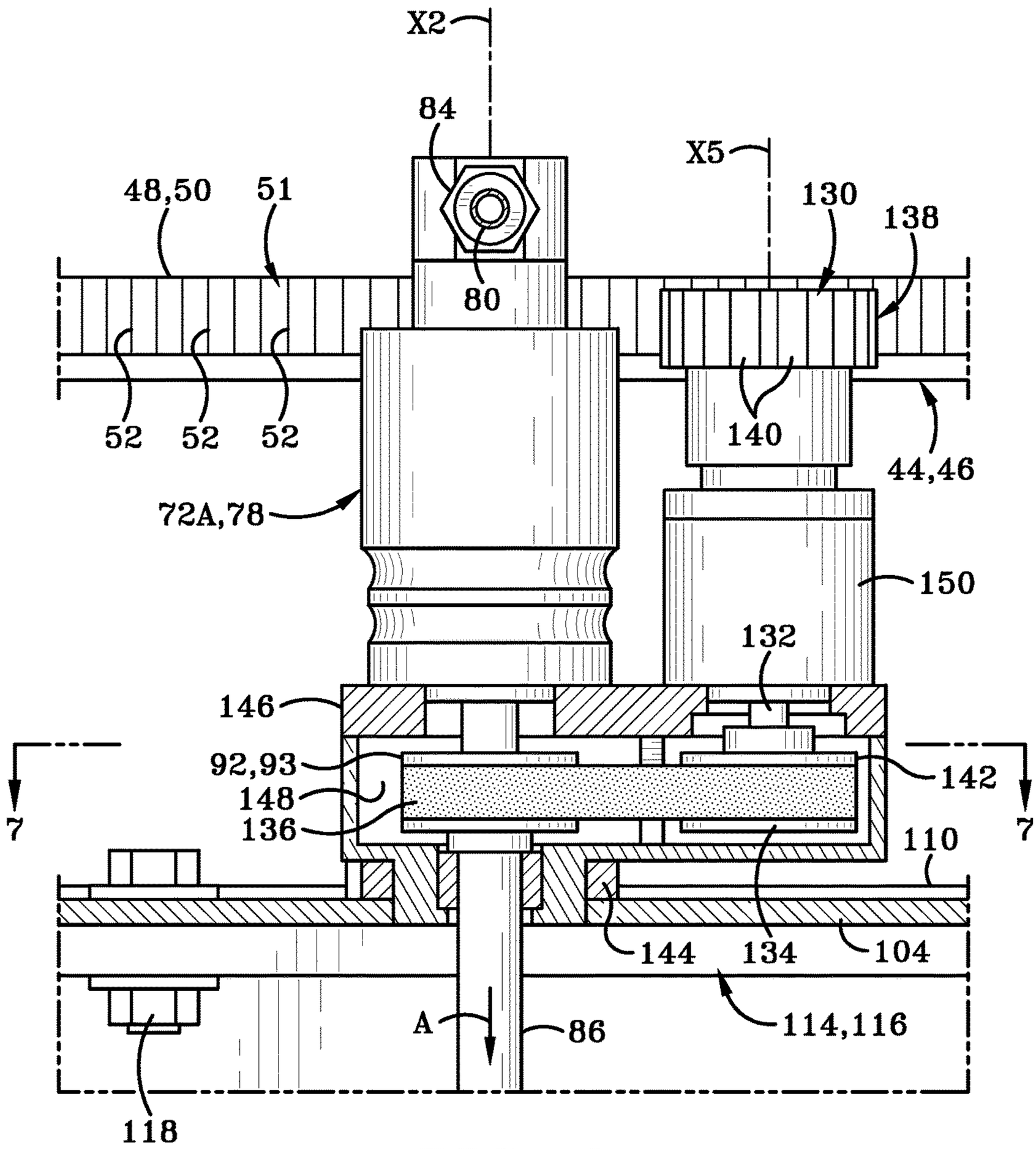
90
A
14
124
126
60,62
22

FIG–5


X2
84
X5
48,50
51
130
138
80
52
52
52
140
44,46
72A,78
150
132
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142
148
136
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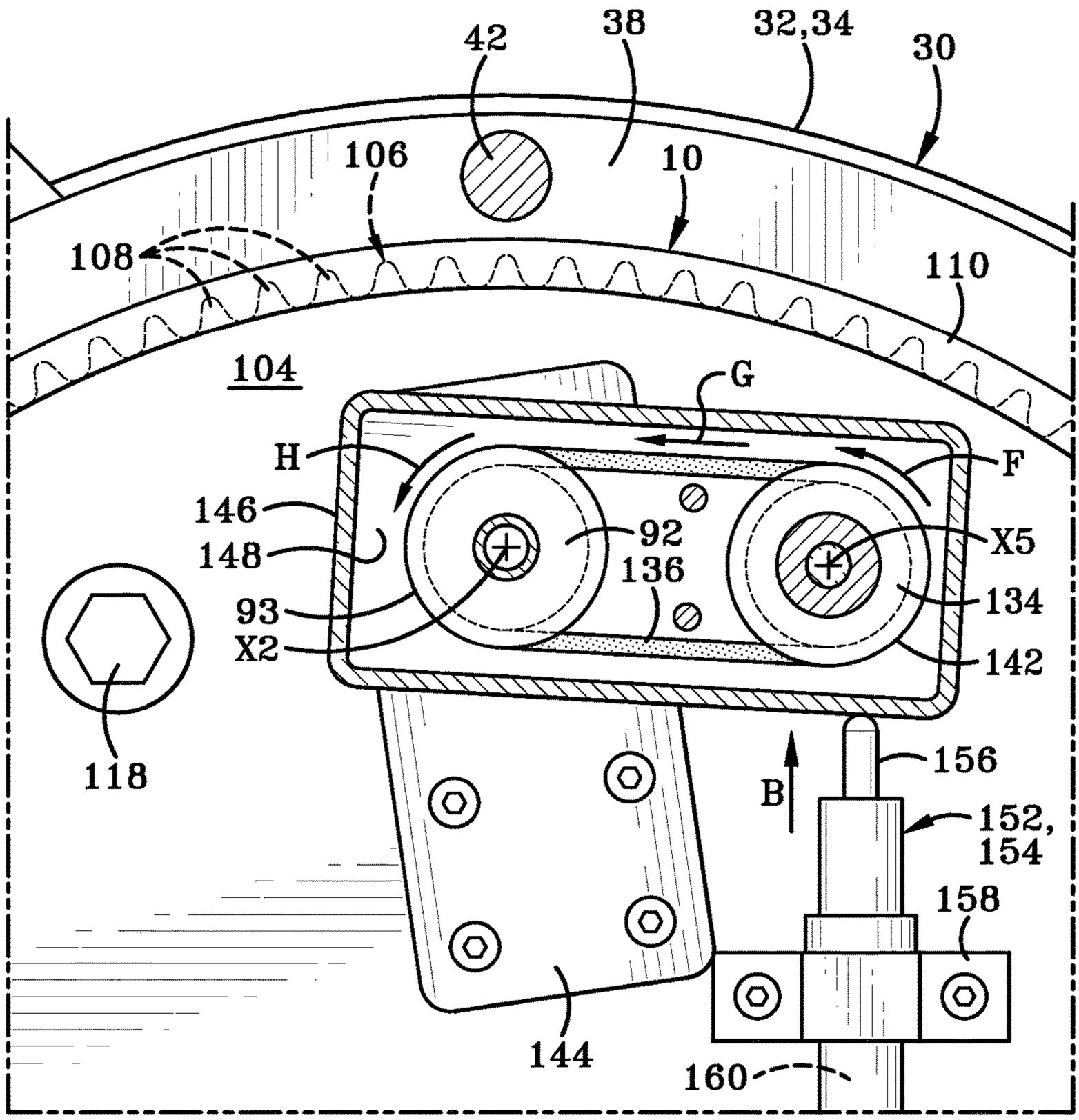
110
144
134
104
A
86
114,116
118

FIG-6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38
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30
106
10
108
110
104
G
H
F
146
148
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X5
136
93
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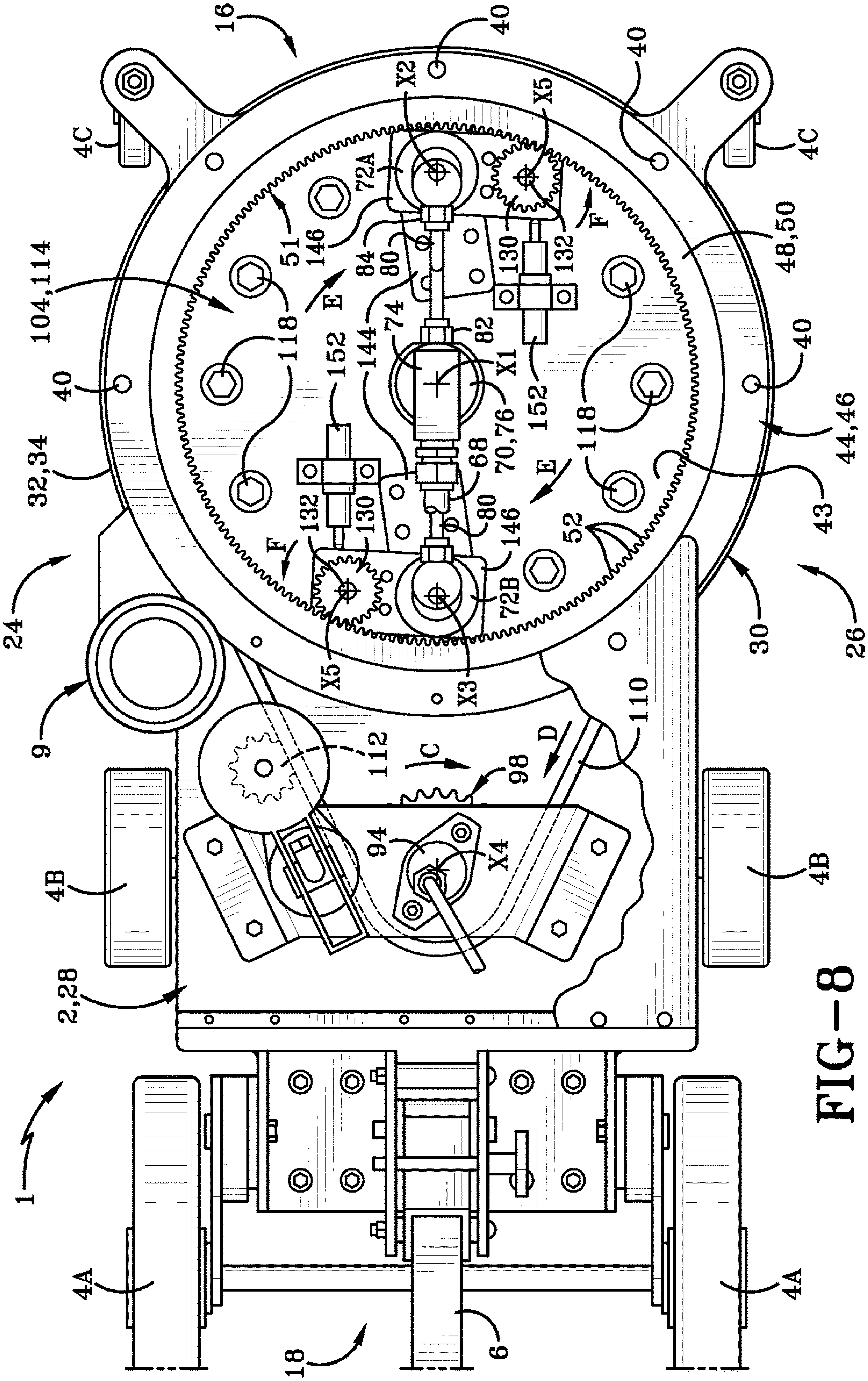
X2
142
118
156
B
152,
154
158
144
160

FIG-7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X2
X5
4C
72A
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146
84
80
130
132
F
48,50
104,114
118
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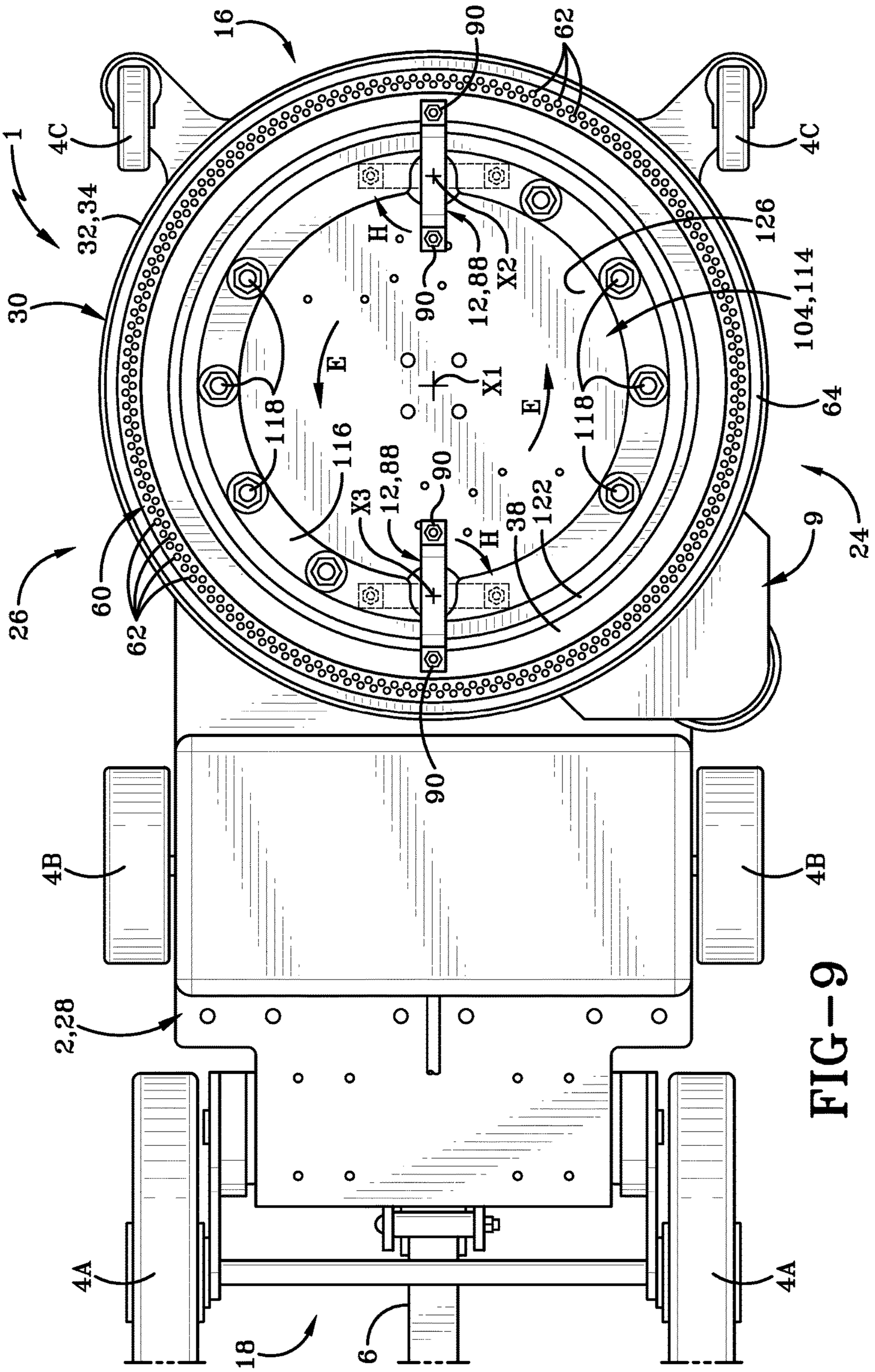
82
152
X1
70,76
68
40
32,34
44,46
43
52
E
80
146
132
130
F
72B
X5
X3
24
26
30
9
110
112
C
D
98
94
X4
4B
2,28
1
4A
18
6

FIG—8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32,34
H
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12,88
X2
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104,114
E
X1
E
118
118
116
64
X3
12,88
90
H
38
122
26
60
62
9
24
90
4B
4B
2,28
4A
4A
18
6

FIG—9

SURFACE CLEANING DEVICE AND METHOD OF OPERATION

BACKGROUND

Technical Field

The technical field relates generally to an apparatus and method related to the use of pressure washing tools or surface cleaning devices.

Background Information

A variety of surface cleaners are known which expel pressurized water onto a surface to clean the surface. Some of these cleaners include nozzle assemblies which rotate as water is expelled as high pressure water jets from nozzles of the nozzle assemblies during the cleaning process. While the rotation of such nozzle assemblies have previously been driven by pneumatic or other systems, there remains a need for improvement in this area.

SUMMARY

In one aspect, a surface cleaner may comprise a frame; a rotatable platform mounted on the frame; and a nozzle assembly mounted on the platform; wherein the nozzle assembly rotates relative to the platform in response to rotation of the platform relative to the frame.

In another aspect, a surface cleaner may comprise a frame; a water feed line; a rotatable platform mounted on and rotatable relative to the frame; a first water swivel having a first portion and a second portion which is rotatable relative to the first portion, wherein the first portion is connected to the water feed line and the second portion is mounted on and rotatable with the platform; an essentially circular perimeter of the frame; a drive train wheel assembly which is mounted on and rotatable relative to the platform and which comprises an axle, a first drive wheel secured to the axle and a second drive wheel secured to the axle, wherein the first drive wheel engages the essentially circular perimeter of the frame; a second water swivel which is mounted on and rotatable with the platform and which has a first portion and a second portion which is a nozzle assembly rotatable relative to the first portion; a conduit extending from an outlet of the second portion of the first water swivel to an inlet of the first portion of the second water swivel; a drive shaft conduit of the nozzle assembly; a third drive train wheel secured to the drive shaft conduit; and a drive loop which engages the second and third drive train wheels.

In another aspect, a method may comprise the steps of rotating a rotatable platform relative to a frame of a surface cleaner to cause rotation of a nozzle assembly which is rotatably mounted on the platform and comprises a nozzle; and moving water through the nozzle to form a water jet which impacts a target surface.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

A sample embodiment is set forth in the following description, is shown in the drawings and is particularly and distinctly pointed out and set forth in the appended claims.

FIG. **1** is a side elevation view of the surface cleaner with portions removed.

FIG. **2** is a bottom plan view of the surface cleaner shown in FIG. **1**.

FIG. **2**A is a diagrammatic sectional view taken on line **2**A-**2**A of FIG. **1** showing part of the drive train.

FIG. **3** is a top plan view of the surface cleaner of FIG. **1**.

FIG. **4** is an enlarged view of the encircled portion of FIG. **3**.

FIG. **5** is a sectional view taken on line **5**-**5** of FIG. **4**.

FIG. **6** is a sectional view taken on line **6**-**6** of FIG. **4**.

FIG. **7** is a sectional view taken on line **7**-**7** of FIG. **6**.

FIG. **8** is a top plan view similar to FIG. **3** showing the operation of various components.

FIG. **9** is a bottom plan view similar to FIG. **2** showing the operation of various components.

Similar numbers refer to similar parts throughout the drawings.

DETAILED DESCRIPTION

A surface cleaning device or surface cleaner is shown generally at **1** in FIGS. **1**-**3**. Cleaner **1** may include a rigid frame **2**, a plurality of wheels **4**A-**4**C which are rotatably mounted on the frame, a handle **6** which is mounted on the frame extending rearwardly therefrom (only a portion shown), a water system or assembly **8** and a nozzle assembly drive train **10** configured to rotate nozzle assemblies **12** (FIG. **2**) of the water assembly **8**. Nozzle assemblies **12** are configured to eject or shoot water jets onto a target surface **14** to be cleaned. Cleaner **1** may include a vacuum system or assembly **9** which may include a vacuum hose **11**.

Cleaner **1** and/or frame **2** may have a front **16** and a back **18** defining therebetween a longitudinal direction, a top and bottom **20** and **22**, and left and right sides **24** and **26** defining therebetween an axial direction of the cleaner or frame. Wheels **4**A are rotatably mounted adjacent the rear ends **18** of frame **2** to rotate about a common horizontal axis which extends in the axial direction from left to right. Likewise, wheels B may be rotatably mounted on frame **2** along a rear section thereof and forward of wheels **4**A to rotate about a horizontal axis which may be parallel to the axis about which wheels **4**A are rotatable. Wheels **4**B may be drive wheels for driving the forward and rearward movement of cleaner **1** along surface **14**. The front wheels **4**C may be caster wheels such that they are rotatably mounted on a caster bracket to rotate about a horizontal axis with the caster bracket being rotatably mounted about a vertical axis on frame **2** adjacent front end **16** thereof. Wheels **4** are thus ground-engaging or surface-engaging wheels which engage ground or surface **14**. Only a portion of handle **6** is shown for simplicity. It is well-known in the art that various controls may be mounted on handle **6** in order to control the various operations of cleaner **1**, such as a control of the forward and rearward movement of the cleaner via drive wheels **4**B, the flow of water through water system **8** to provide the cleaning water jets, and/or other motors or actuators such as pneumatic motors, hydraulic motors or electric motors.

Frame **2** may include a rear section **28** and a front section **30** which is secured to and extends forward from the front of rear section **28** to the front or front end **16**. Front section **30** of frame **2** may include an annular sidewall **32** which may be circular as viewed from above and which may include a lower or skirt ring **34**, an intermediate ring **36** which is secured to and extends upwardly from lower ring **34**, and an upper or bearing ring **38** which is secured to and extends upwardly from intermediate ring **36**. Lower ring **34** and intermediate ring **36** may be secured to one another by various fasteners or screws **40** (FIG. **5**), and likewise upper ring **38** and intermediate ring **36** may be secured to one another by various fasteners or screws **40** or the like. Front section **30** may further include a plurality of uprights or

posts **42** which are rigidly secured to and extend upwardly from upper ring **38**. The same fasteners or screws **40** which are used to secure intermediate ring **36** to upper ring **38** may likewise be used to secure rings **36** and **38** and posts **42** to one another. Posts **42** may lie along a common circle as viewed from above and may be positioned around a space **43** (FIGS. **3**, **5**) which may extend upwardly from adjacent the bottom of posts **42** to adjacent the top of posts **42**. Space **43** may extend upwardly from adjacent the top of sidewall/ring **38** and upwardly above the top of sidewall **32**/ring **38**. An upper portion of sidewall **32**/ring **38** may be disposed in space **43**.

Front section **30** may further include a drive train ring assembly or gear ring assembly **44** which may include an annular mounting flange **46** and a drive train ring or gear ring **48**. Ring assembly including flange **46** and ring **48** may be spaced upwardly of the top of sidewall **32** and ring **38** adjacent the top of space **43** along the outer perimeter of space **43**. Portions of flange **46** and/or ring **48** may be directly above portions of sidewall **32**. Ring assembly **44** may be rigidly secured to the top of posts **42** such as by a plurality of fasteners or screws **40** which may extend from flange **46** to a respective post **42**. Ring **48** may be secured to and extend radially inwardly from flange **46**. Both flange **46** and ring **48** may be circular as viewed from above and may be essentially horizontal as viewed from the side. Ring **48** may include an annular wall **50** with a plurality of gear teeth **52** extending therefrom. Annular wall **50** may have an essentially circular inner perimeter **51** along which gear teeth **52** may be formed. In the sample embodiment, gear teeth **52** extend along the entire circumference of annular wall **50** and may extend radially inwardly therefrom as shown in the figures although teeth **52** may extend in other directions. For instance, a ring similar to ring **48** may be formed with a set of teeth extending radially outward from an annular wall such that the set of teeth extend along an essentially circular outer perimeter of the annular wall or ring. Similar teeth may also extend downwardly, upwardly or at various angles from an annular wall of a ring analogous to ring **48** (for instance, the ring may be a beveled gear ring with teeth extending outwardly from an annular wall at about 30 or 45 or 60 degrees or another angle relative to horizontal or vertical). Gear teeth **52** may be in any of these cases arranged along a circle or circular path as viewed from above. The inner circumference or perimeter **51** of gear ring **48** or gear teeth **52** define therewithin a generally horizontal space **54** which may be circular as viewed from above. Space **54** may have a top or top entrance opening **56** and a bottom or bottom entrance opening **58** inasmuch as space **54** opens upwardly and downwardly.

A skirt **60** may be secured to and extend downwardly from the bottom of skirt ring **34** and may include multiple bristles **62** arranged generally in an annular or circular fashion as viewed from below. Skirt **60** may also include a seal **64** which may be formed of an elastomer or plastic material for example. Seal **64** may have an annular circular configuration as well. The bottom of skirt **60** may be closely adjacent or in contact with target surface **14** when cleaner **1** is being used to clean surface **14**.

One or more wheel drive motors or actuators **66** (FIG. **2**) may be mounted on a rear section **28** of frame **2** and may be operatively connected to drive wheels **4**B in order to drive rotation of wheels **4**B to effect forward, rearward or other movement of cleaner **1** along surface **14**. Motors or actuators **66** may be for example pneumatic, hydraulic or electric motors or actuators.

Water system or assembly **8** may include a source of water with a pump which is in fluid communication with nozzle assemblies **12** via various conduits and water swivels. Assembly **8** may include a main water feed line **68** which may extend over a portion of flange **46**, ring **48** and space **54** and which may be connected at a front end thereof to an inlet of a central water swivel **70**. There may be one or more additional water swivels such as swivels **72**A and **72**B which may be spaced from one another and swivel **70** such that swivel **70** is generally or directly between swivels **72**A and **72**B. Swivels **72** may be referred to as nozzle assembly water swivels. Swivel **70** may have an upper or first swivel portion **74** and a second or lower swivel portion **76** such that portion **74** is rotatable relative to portion **76** about a vertical axis X**1**. Each of swivels **72** has a first or upper swivel portion **78** and a second or lower swivel portion which is also the corresponding nozzle assembly **12** such that portion or assembly **12** of swivel **72**A is rotatable relative to portion **78** of swivel **72**A about a vertical axis X**2** and portion or assembly **12** of swivel **72**B is rotatable relative to portion **78** of swivel **72**B about a vertical axis X**3**. Thus, each of axes X**1**, X**2** and X**3** may be parallel to one another and may also lie in a common vertical plane. Part of or a majority of lower portion **76** of swivel **70** may be in space **43**. Likewise, part of or a majority of upper portion **78** of each swivel **72**A and **72**B may be in space **43**.

A pair of water conduits **80** may be connected to and extend between respective outlets **82** of swivel portion **76** of swivel **70** and respective inlets **84** of portions **78** of swivels **72**A and **72**B. Each nozzle assembly **12** may include a nozzle assembly drive shaft conduit **86**, a nozzle arm or bar **88** and a plurality of nozzles **90**. The water system or water assembly components thus define respective water passages or water flow passages which form a water flow pathway such that this pathway and the water flow are represented by Arrows A in FIGS. **1** and **3**-**6**. More particularly, when water is being pumped through the water system, water may flow from a source of water through feed line **68** and into the main swivel **70** through the inlet of portion **74** of swivel **70**, through swivel **70** and the outlets **82** thereof, through conduits **80** and inlets **84** of the respective swivel **72**A and **72**B, through swivels **72**A and **72**B into and through nozzle assemblies **12** including conduit **86** and bar **88**, and out of the respective nozzles **90** as water jets which impact target surface **14** to clean surface **14**.

A drive train wheel or sheave **92** may be mounted on conduit **86** and extend radially outwardly therefrom, and may have an essentially circular outer perimeter **93**. Conduit **86** may be essentially vertical and have a portion extending upwardly within portion **78** of the given swivel **72** and a portion which extends downwardly below and out of portion **78** of a given swivel **72**. Nozzle arm or bar **88** may be secured to the bottom of conduit **86** and extend radially outwardly therefrom and may be essentially horizontal. Bar **88** may have portions that extend in opposite directions from one another away from the connection with conduit **86**. Nozzles **90** may be secured to and extend downwardly from arm **88** such that nozzles are spaced radially outwardly of conduit **86**. Nozzles **90** ay be directed downwardly and toward target surface **14** when cleaner **1** is in its operational position with its bottom against or adjacent surface **14**, which may include the various wheels **4** being in contact with surface **14** and skirt **60** adjacent or in contact with surface **14**.

As viewed from above, swivels **70** and **72** and conduits **80** may be or extend within the circles or vertical cylinders defined by the inner perimeters of sidewall **32**, flange **46**,

ring **48**, and swivel **70** may be at the center of said circles or vertical cylinders. Part of or a majority of each conduit **80** may be in space **43**. Portions of swivels **70** and **72** and conduits **80** may extend within space **54**, and/or above space **54** and flange **46** and ring **48**, and/or below space **54** and flange **46** and ring **48**.

The water system or assembly, including the various conduits, water swivels and nozzle assemblies, may be essentially the same as or similar to those described in U.S. Patent Application Publication 2013/0118529 of Gromes Sr., which is incorporated herein by reference.

Nozzle assembly drive train **10** is now described in greater detail. A motor **94** (FIGS. **1**, **3**) may be provided to drive rotation of nozzle assemblies **12** via drive train **10**. Motor **94** may be a pneumatic motor, a hydraulic motor or an electric motor, for example. Motor **94** may be secured to rear section **28** of frame **2** and have a rotational output or drive shaft **96** (FIG. **2**A) which may be rotatable about a vertical axis X**4** (FIGS. **1**, **2**A, **3**). With primary reference to FIG. **2**A, drive train **10** may include a drive train wheel **98** having an essentially circular outer perimeter **100**. Wheel **98** may include sprocket teeth **102** all along the outer perimeter **100** thereof. Wheel **98** may be rigidly secured to and extend radially outwardly from rotational output **96** such that wheel **98** may rotate with output **96** about axis X**4**. Outer perimeter **100** may be concentric about axis X**4**.

Drive train **10** may further include a drive train plate or wheel **104** which may be positioned to rotate about axis X**1**. Drive train wheel **104** may be substantially horizontal and may have an essentially circular outer perimeter **106** which may be essentially concentric about axis X**1**. Wheel **104** may be entirely higher than the top of sidewall **32**. Wheel or plate **104** may include a set of multiple teeth **108** all along its outer perimeter **106**. Perimeter **106**/set of teeth **108** may in its entirety extend adjacent sidewall **32** and may be directly above or higher than sidewall **32**.

Drive train **10** may further include a flexible drive loop **110** which may be a closed loop in the form of a chain or flexible belt. Drive loop **110** may extend from rearward of the back of sidewall **32** forward to adjacent the front of sidewall **32** and front end **16** of frame **2**/cleaner **1**. Drive loop **110** may also extend adjacent the left and right sides of sidewall **32** and left and right sides **24** and **26** of frame **2**/cleaner **1**. Drive loop **110** may be looped around wheels **98** and **104** and may engage said wheels along their outer perimeters **100** and **106**. Loop **110** may engage teeth **102** and **108** when wheels **98** and **104** include such teeth. The rotation of wheel **98** causes or drives rotation of wheel **104** via drive loop **110**, which is caused to revolve by the rotational movement of wheel **98**. Said in another way, the rotational movement of drive train wheel **98** may be translated to rotational movement of drive loop **110**, which may be translated to rotational movement of wheel **104**. Drive train wheel **104** typically has a substantially larger diameter than drive train wheel **98**, and may have a diameter which is at least two or three times that of wheel **98**. A tensioner wheel **112** may be provided to engage loop **110** to provide sufficient tension to loop **110**.

With primary reference to FIG. **5**, wheel **104** may be part of a rotatable platform **114** which may also include a bearing ring **116** with a plurality of fasteners **118** which rigidly secure ring **116** to wheel **104**. Fasteners **118** may include threaded bolts which pass through corresponding holes in plate **104** and ring **116**, along with nuts which threadedly engage the bolts. Ring **116** may extend downwardly from the bottom of plate **104** adjacent and spaced inwardly of the outer perimeter **106**/teeth **108** of plate **104** such that outer perimeter **106**/teeth **108** extend radially outwardly beyond the outer perimeter of ring **116**. Rotatable platform **114** may be rotatably mounted on front section **30** of frame **2** by a plurality of roller bearings or ball bearings **120** (only one shown in FIG. **5**) which are positioned along the circular outer perimeter of bearing ring **116** and along the circular inner perimeter of bearing ring **38**. Upper and lower annular seals **122** may be provided directly above and below the bearings **120** to help prevent water and other undesired materials from entering the space between the inner perimeter of bearing ring **38** and outer perimeter of bearing ring **116**. Seal **122** may be formed of an elastomeric material or other suitable material.

Platform **114** and sidewall **32** of front section **30** may together form a nozzle assembly housing **124** which defines a nozzle assembly housing cavity **126** having a bottom entrance opening **128**. Wheel/plate **104** may define the top of cavity **126**, and the inner surface of sidewall **32** may define the outer perimeter of cavity **126**. Vacuum hose **11** may be in fluid communication with nozzle assembly housing cavity **126**. Nozzle assembly conduits **86** may extend downwardly from above plate **104** and ring **116** through respective through holes in plate **104** and ring **116** to below plate **104** and ring **116** within cavity **126** such that a portion of each conduit **68** is above platform **114**, a portion within one of the through holes in platform **114** and a portion below platform **114** within cavity **126**. Bar **88** and nozzles **90** of nozzle assemblies **12** may be entirely within cavity **126** adjacent sidewall **32**.

Various components are mounted on rotatable platform **114** and thus rotatable therewith about axis X**1**. These components may include portion **76** of swivel **70**, swivel **72**A and **72**B, conduits **80** and various components of drive train **10**. Portion **76** of swivel **70** may be secured to wheel **104** of platform **114** and extend upwardly therefrom. Similarly, portion **78** of each swivel **72** may be secured to wheel **104** of platform **114** and extend upwardly therefrom.

With primary reference to FIG. **6**, drive train **10** may further include a drive train wheel or gear or pinion **130**, a drive shaft or axle **132**, a drive train wheel or sheave **134** and a flexible drive loop **136**. Wheel **130** may be rigidly secured to axle **132** and extend radially outwardly therefrom adjacent a top end of axle **132**. Wheel **134** may be rigidly secured to and extend radially outwardly from axle **132** adjacent a lower end of axle **132**. Thus, wheels **130** and **134** may rotate together with axle **132** about a vertical axis X**5** which may be parallel to the other axes X**1**, X**2**, X**3** and X**4**. Each set of wheels **130** and **134** and a given axle **132** together may be referred to as a drive train wheel assembly or a pinion assembly which is rotatable about axis X**5**. Wheel **130** may have an essentially circular outer perimeter **138** and may have formed along perimeter **138** gear teeth **140** extending around the entire perimeter **138**. Wheel **134** may have an essentially circular outer perimeter **142**. In the sample embodiment, gear teeth **140** may extend radially outwardly as shown in the figures although teeth **140** may extend in other directions. For instance, a wheel similar to wheel **130** may be formed with a set of teeth extending downwardly, upwardly or at various angles (for instance, the wheel may be a beveled gear with teeth extending outwardly at about 30 or 45 or 60 degrees or another angle relative to horizontal or vertical).

With primary reference to FIGS. **3**-**6**, wheel **130** may be within or adjacent space **54** and in engagement with ring **48** of front section **30** of frame **2**. Outer perimeter **138** of wheel **130** may be in contact with or engage inner perimeter **51** of ring **48**. Where inner perimeter **51** includes gear teeth **52** and

outer perimeter **138** includes gear teeth **140**, teeth **52** and **140** may engage or mesh with one another. Drive loop **136** may engage and be looped around wheels **92** and **134** such that rotation of shaft **132** and wheels **130** and **134** about axis X**5** causes revolution or revolving movement of drive loop **136** which in turn causes rotation of wheel **92** and nozzle assembly **12** including shaft or conduit **86**, bar **88** and nozzles **90**. Wheels **92** and **134** may be sheaves such that drive loop **136** may be a flexible drive belt which engages sheaves **92** and **134** generally along or adjacent outer perimeters **93** and **142**. Likewise, wheels **92** and **134** may be sprockets having teeth such that drive loop **136** may be a chain which engages the teeth of the sprockets along the outer perimeters **93** and **142** thereof. Wheels **92** and **134** and axle **132** may be in or extend within space **43**. Wheel **130** may extend within or be adjacent an upper portion of space **43**.

With primary reference to FIGS. **3-6** and **7**, various components are mounted on rotatable platform **114** and rotate therewith about axis X**1**. In addition to swivels **72**A and **72**B and portion **76** of swivel **70**, these components may include a pair of mounting blocks or plates **144** and a corresponding pair of rigid chambers **146** which are pivotally mounted on plate **104** via mounting plate **144** to respectively pivot about axes X**2** and X**3** relative to platform **114**. Each mounting block **144** may be rigidly secured to plate **104** such as by various bolts or fasteners or other means known in the art and may extend upwardly therefrom within a lower portion of space **43**. Each chamber **146** may also be in or extend within space **43**. Chamber **146** has a top wall, bottom wall and sidewall which define therewith an interior chamber **148** (FIGS. **5-7**) in which may be disposed wheels **92** and **134** along with drive loop **136**. In addition, a lower end of shaft **132** is disposed in interior chamber **148**, as is a portion of shaft or conduit **86**. Portion **78** of swivel **72**A is secured to and extends upwardly from the top wall of one of chambers **146**. Likewise, portion **78** of swivel **72**B is secured to and extends upwardly from the top wall of the other chamber **146**. Also amongst the components which may rotate with platform **114** are a pair of axle housings **150** which may be secured to and extend upwardly from the top walls of respective chambers **146** within space **43**. Axles **132** are rotatably mounted on and pass through one of axle housings **150**. Each housing **150** along with its drive train wheel assembly and walls of chamber **146** may be rotatable relative to platform **114**. Also amongst the components which may rotate with platform **114** may be a pair of biasing units **152** each which may be mounted on the top of plate **104** and extend upwardly therefrom within space **43**. Each unit **152** may include a first member or cylinder **154**, a second member or piston **156**, a mount **158** and an internal spring **160**. First member or cylinder **154** may be secured to plate **104** by mount **158** and bolts or other fasteners or the like. First member **154** may be secured so as to be fixed relative to plate **104**. Second member **156** may be a movable member or piston which is movable relative to first member **154** and platform **114**. First member **154** may be a cylinder or define an interior chamber in which a portion of the first member or piston **156** is disposed with a second portion thereof extending outwardly from the first member or cylinder. A spring **160** may be disposed within first member or cylinder **154** to bias the second member or piston **156** outward away from cylinder **154** and toward chamber **146**. More particularly, the movable member or piston **156** may have a tip or surface which engages an outer surface of chamber **146** in order to bias wheel **130** toward or against ring **48**, which may mean biasing perimeter **138** against perimeter **51** or teeth **140** against teeth **52**. This biasing movement or direction is illustrated at Arrow B in FIGS. **4** and **7**.

In order to clean surface **14** with cleaner **1**, the operator may position cleaner **1** atop surface **14** with wheels **4** in contact with surface **14** and skirt **60** in contact or closely adjacent surface **14**. The operator of cleaner **1** may then manipulate various controls typically located on handle **6** in order to cause water to flow through the water pathway represented by Arrows A as previously discussed in order to create water jets (lower Arrows A in FIG. **5**) which are expelled through nozzles **90** to impact surface **14**. As water is being ejected or forced through nozzles **90** onto surface **14**, the vacuum system **9** may be operated to suction water out of housing cavity **126** through vacuum hose **11** and cleaner **1** may be moved along surface **14** via rolling on wheels **4**.

While water is being directed through nozzles **90** onto target surface **14** and also being suctioned out of cavity **126** through hose **11**, and while cleaner **1** is stationary or rolling on surface **14**, nozzle assemblies **12** may be rotated about the respective axes X**2** and X**3** in response to the driving rotation of the rotational output **96** (FIG. **2**A) of motor **94** (FIG. **8**). Nozzle assemblies **12** may also rotate in response to rotation or revolving movement of the various components of drive train **10**. More particularly and with primary reference to FIGS. **8** and **9**, motor **94** may be operated or turned on to drive rotation of output or shaft **96** (FIG. **2**A) to in turn drive the rotation of wheel **98** (Arrow C in FIG. **8**) about axis X**4**. The rotation of wheel **98** in turn drives the revolution or revolving movement (Arrow D in FIG. **8**) of drive belt **110** which in turn causes the rotation (Arrows E in FIGS. **8**, **9**) of rotatable platform **114** about axis X**1**. As previously noted, various components are rotatable with platform **114**, whereby the rotation of platform **114** likewise includes the rotation of these various components, including swivels **72**A and **72**B, portion **76** of swivel **70**, axles **132**, wheels **130**, wheels **134**, wheels **92**, mounting blocks **144**, chambers **146**, biasing units **152** and nozzle assemblies **12**. The rotation of platform **114** and these various components mounted thereon or carried thereby may rotate in the same direction as wheel **98** and output **96**. During the rotation of platform **114** about axis X**1** as shown at Arrow C, the engagement between the outer perimeters **138**/teeth **140** of respective wheels or gears **130** may engage the inner perimeter **51**/teeth **52** of ring **48**, thereby causing the rotation (Arrows F in FIGS. **7**, **8**) of wheels **130**, axles **132** and wheels **134** about respective axes X**5**, wherein the same rotation represented by Arrows F may be the opposite direction as the rotation of the various components represented by rotation of Arrows E and Arrow C. Rotation of wheel **134** drives the revolution or revolving movement (Arrow G in FIG. **7**) of drive loop **136**, which in turn drives the rotation (Arrow H in FIG. **7**) about axis X**2** or X**3** of the given wheel **92** and nozzle assembly **12** including the conduit **86**, bar **88** and nozzles **90** thereof. The given wheel **92** and nozzle assembly **12** may thus rotate in the same direction as the components indicated by Arrow F.

The various components of drive train **10** may include drive train components which are upstream or downstream of other drive train components of drive train **10**. Thus, rotation or revolving movement of a given relatively upstream drive train component which is upstream of a given relatively downstream drive train component may cause or drive the corresponding rotation or revolving movement of the given relatively downstream drive train component. It may also be said that a given relatively downstream drive train component which is downstream of

a given relatively upstream drive train component may rotate or revolve in response to the corresponding rotation or revolving movement of the given relatively upstream drive train component.

In the foregoing description, certain terms have been used for brevity, clearness, and understanding. No unnecessary limitations are to be implied therefrom beyond the requirement of the prior art because such terms are used for descriptive purposes and are intended to be broadly construed. Moreover, the description and illustration set out herein are an example not limited to the exact details shown or described.

The invention claimed is:

1. A surface cleaner comprising:

a frame;

a motor mounted on the frame and having a drive shaft which is rotatable about a first axis;

a rotatable platform having an outer peripheral edge; said rotatable platform being mounted on the frame and being rotatable about a second axis that is different from the first axis; wherein the first axis is parallel to the second axis and is spaced a distance outwardly from the outer peripheral edge of the rotatable platform;

a nozzle assembly mounted on the platform;

a first water swivel comprising a first portion; wherein the nozzle assembly is a second portion of the first water swivel which is rotatable relative to the first portion;

a water feed line;

a second water swivel having a first portion and a second portion which is rotatable relative to the first portion, wherein the first portion of the second water swivel is connected to the water feed line and the second portion of the second water swivel is mounted on and rotatable with the platform;

a conduit extending from an outlet of the second portion of the second water swivel to an inlet of the first portion of the first water swivel;

an axle;

a first drive train wheel secured to the axle;

a second drive train wheel secured to the axle; wherein the axle, first drive train wheel and second drive train wheel rotate together;

a drive shaft conduit of the nozzle assembly;

a third drive train wheel secured to the drive shaft conduit;

a drive loop which engages the second and third drive train wheels;

a fourth drive train wheel secured to the drive shaft; and

a drive loop engaging the fourth drive train wheel and the outer peripheral edge of the platform.

2. The surface cleaner of claim **1** further comprising an essentially circular perimeter of the frame; wherein the first drive train wheel engages the essentially circular perimeter of the frame.

3. The surface cleaner of claim **2** further comprising a biasing unit which biases the first drive train wheel toward engagement with the essentially circular perimeter of the frame.

4. The surface cleaner of claim **1** wherein the platform comprises a set of teeth; and further comprising a chain which engages the set of teeth.

5. The surface cleaner of claim **1** further comprising a drive train; wherein the nozzle assembly revolves relative to the second axis via the drive train; and the drive train comprises a drive train wheel assembly which is rotatable relative to the platform and which comprises an axle, a first drive wheel secured to the axle and a second drive wheel secured to the axle.

6. The surface cleaner of claim **5** further comprising a wall that is mounted on and pivotable relative to the platform; wherein the drive train wheel assembly is mounted on the wall.

7. A surface cleaner comprising:

a frame;

a motor mounted on the frame and having a drive shaft which is rotatable about a first axis;

a rotatable platform having an outer peripheral edge; said rotatable platform being mounted on the frame and being rotatable about a second axis that is different from the first axis; wherein the first axis is parallel to the second axis and is spaced a distance outwardly from the outer peripheral edge of the rotatable platform;

a nozzle assembly mounted on the platform;

a drive train; wherein the nozzle assembly revolves relative to the second axis and rotates relative to a third axis which is different from the first axis and the second axis via the drive train; and wherein the drive train comprises a first set of teeth of the frame and a pinion which engages the first set of teeth; and wherein the drive train comprises an axle on which the pinion is mounted, and a first sheave secured to the axle.

8. The surface cleaner of claim **7** wherein the drive train comprises a nozzle assembly drive shaft conduit and a second sheave mounted on the nozzle assembly drive shaft conduit; and the nozzle assembly is mounted on the nozzle assembly drive shaft conduit.

9. The surface cleaner of claim **7** wherein the drive train comprises a second set of teeth of the platform; and further comprising a chain which engages the second set of teeth.

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